In the claims:

1. (Currently Amended) A probe testing apparatus for testing an end shape of a contact probe brought into pressure contact with a contact pad on an integrated circuit, said apparatus comprising:

~~means for detecting~~ a detecting unit for detecting a surface shape of at least one of said contact pad and said contact probe as three-dimensional data;

~~means for analyzing~~ an analyzing unit for analyzing the surface shape through imaging; and

~~means for determining~~ a determining unit for determining from the result of the analysis whether said contact probe is acceptable or defective.

2. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a pad scanning ~~means~~unit for scanning the surface shape of said contact pad in pressure contact with said contact probe to read three-dimensional data of the surface shape;

a part extracting ~~means~~unit for differentiating the read surface shape to extract a multiplicity of flat parts;

a reference generating ~~means~~unit for complementing the multiplicity of extracted flat parts to generate a reference shape;

a recess detecting ~~means~~unit for subtracting said generated reference shape from the read surface shape to detect a plurality of recesses having a predetermined depth or more;

a recess selecting ~~means~~unit for selecting one from the plurality of detected recesses corresponding to reference information;

a recess enlarging ~~means~~unit for enlarging the selected recess outward by predetermined dimensions;

an impression detecting ~~means~~unit for subtracting said reference shape from the read surface shape at the position of the enlarged recess to detect an impression of said contact probe;

a shape detecting ~~means~~unit for detecting at least one of a depth, a position and a shape of the detected impression; and

a probe determining ~~means~~unit for determining from at least one of the detected depth, position and shape of the impression whether said contact probe is acceptable or defective.

3. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a pad scanning ~~means~~unit for scanning the surface shape of said contact pad in pressure contact with said contact probe to read three-dimensional data of the surface shape;

a surface averaging ~~means~~unit for averaging the read surface shape;

a part extracting ~~means~~unit for differentiating the averaged surface shape to extract a multiplicity of flat parts;

a reference generating ~~means~~unit for complementing the multiplicity of extracted flat parts to generate a reference shape;

a recess detecting ~~means~~unit for subtracting the generated reference shape from the averaged surface shape to detect a plurality of recesses having a predetermined depth or more;

a recess selecting ~~means~~unit for selecting one from the plurality of detected recesses corresponding to reference information;

a recess enlarging ~~means~~unit for enlarging the selected recess outward by predetermined dimensions;

an impression detecting ~~means~~unit for subtracting said reference shape from the read surface shape at the position of the enlarged recess to detect an impression of said

contact probe;

a shape detecting ~~means~~unit for detecting at least one of a depth, a position and a shape of the detected impression; and

a probe determining ~~means~~unit for determining from at least one of the detected depth, position and shape of the impression whether said contact probe is acceptable or defective.

4. (Currently Amended) The probe testing apparatus according to claim 2, wherein:

said pad scanning ~~means~~unit scans the shape of a surface of said contact pad in pressure contact with said contact probe from a Z-direction, said surface being parallel with an X-direction and a Y-direction; and

said recess selecting ~~means~~unit comprises reference storing ~~means~~unit for storing an X-direction length, a Y-direction length, and an area in the XY-directions as said reference information; and recess measuring ~~means~~unit for detecting the X-direction length, the Y-direction length, and the area of each of said plurality of recesses as actually measured information; and recess comparing ~~means~~unit for selecting a recess which has the actually measured information that presents the X-direction length, the Y-direction length, and the area exceeding their counterparts in said reference information, respectively.

5. (Currently Amended) The probe testing apparatus according to claim 3, wherein:

said pad scanning ~~means~~unit scans the shape of a surface of said contact pad in pressure contact with said contact probe from a Z-direction, said surface being parallel with an X-direction and a Y-direction; and

said recess selecting ~~means~~unit comprises reference storing ~~means~~unit for storing an X-direction length, a Y-direction length, and an area in the XY-directions as said

reference information; and recess measuring ~~means~~unit for detecting the X-direction length, the Y-direction length, and the area of each of said plurality of recesses as actually measured information; and recess comparing ~~means~~unit for selecting a recess which has the actually measured information that presents the X-direction length, the Y-direction length, and the area exceeding their counterparts in said reference information, respectively.

6. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a probe imaging ~~means~~unit for imaging the end shape of said contact probe from an axial direction to read three-dimensional data of the end shape;

a cross-section detecting ~~means~~unit for detecting a cross-sectional area of said contact probe at a predetermined position thereof from the imaged end shape; and

a probe determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range.

7. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a probe imaging ~~means~~unit for imaging the end shape of said contact probe from an axial direction to read three-dimensional data of the end shape;

a peak detecting ~~means~~unit for detecting a peak of said contact probe in the axial direction from the imaged end shape;

a cross-section detecting ~~means~~unit for detecting a cross-sectional area of said contact probe at a position retraced by a predetermined distance in the axial direction from the detected peak; and

a probe determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls

within a predetermined tolerance range.

8. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a probe imaging ~~means~~unit for imaging an end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a flat part detecting ~~means~~unit for detecting a flat part perpendicular to the axial direction from the imaged end shape;

a curvature detecting ~~means~~unit for sequentially detecting curvatures along a contour of the detected flat part;

a fragment detecting ~~means~~unit for detecting a fragmentary length of the contour over which the detected curvature falls within a predetermined abnormal range; and

a probe determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of a total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range.

9. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a probe imaging ~~means~~unit for imaging an end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a flat part detecting ~~means~~unit for detecting a flat part perpendicular to the axial direction from the imaged end shape;

a curvature detecting ~~means~~unit for sequentially detecting curvatures along a contour of the detected flat part;

a curvature averaging ~~means~~unit for individually averaging a multiplicity of the detected curvatures;

a fragment detecting ~~means~~unit for detecting a fragmentary length of the contour over which the averaged curvature falls within a predetermined abnormal range; and

a probe determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range.

10. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a probe imaging ~~means~~unit for imaging an end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a flat part detecting ~~means~~unit for detecting a flat part perpendicular to the axial direction from the imaged end shape;

an area detecting ~~means~~unit for detecting the area of the detected flat part;

a diameter detecting ~~means~~unit for detecting a maximum diameter of the detected flat part;

an area calculating ~~means~~unit for calculating the area of the flat part from the detected diameter; and

a probe determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the detected area to the calculated area falls within a predetermined tolerance range.

11. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a probe imaging ~~means~~unit for imaging an end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a peak detecting ~~means~~unit for detecting a peak of said contact probe in the

axial direction from the imaged end shape;

a cross-section detecting ~~means~~unit for detecting a cross-sectional area of said contact probe at a position retraced by a predetermined distance in the axial direction from the detected peak;

a first determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range;

a flat part detecting ~~means~~unit for detecting a flat part perpendicular to the axial direction from the imaged end shape;

a curvature detecting ~~means~~unit for sequentially detecting curvatures along a contour of the detected flat part;

a fragment detecting ~~means~~unit for detecting a fragmentary length of the contour over which the detected curvature falls within a predetermined abnormal range;

a second determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of a total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range;

an area detecting ~~means~~unit for detecting the area of the detected flat part;

a diameter detecting ~~means~~unit for detecting a maximum diameter of the detected flat part;

an area calculating ~~means~~unit for calculating the area of the flat part from the detected diameter;

third determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the detected area to the calculated area falls within a predetermined tolerance range; and

a final determining ~~means~~unit for definitely determining that said contact probe is defective when at least one of said first determining ~~means~~unit, said second

determining ~~means~~unit, and said third determining ~~means~~unit determines that said contact probe is defective.

12. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a probe imaging ~~means~~unit for imaging an end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a peak detecting ~~means~~unit for detecting a peak of said contact probe in the axial direction from the imaged end shape;

a cross-section detecting ~~means~~unit for detecting a cross-sectional area of said contact probe at a position retraced by a predetermined distance in the axial direction from the detected peak;

a first determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range;

a flat part detecting ~~means~~unit for detecting a flat part perpendicular to the axial direction from the imaged end shape;

a curvature detecting ~~means~~unit for sequentially detecting curvatures along a contour of the detected flat part;

a curvature averaging ~~means~~unit for individually averaging a multiplicity of the detected curvature;

a fragment detecting ~~means~~unit for detecting a fragmentary length of the contour over which the averaged curvature falls within a predetermined abnormal range;

a second determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of a total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range;

an area detecting ~~means~~unit for detecting the area of the detected flat part;

a diameter detecting ~~means~~unit for detecting a maximum diameter of the detected flat part;

an area calculating ~~means~~unit for calculating the area of the flat part from the detected diameter;

a third determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the detected area to the calculated area falls within a predetermined tolerance range; and

a final determining ~~means~~unit for definitely determining that said contact probe is defective when at least one of said first determining ~~means~~unit, said second determining ~~means~~unit, and said third determining ~~means~~unit determines that said contact probe is defective.

13. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a probe imaging ~~means~~unit for imaging an end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a peak detecting ~~means~~unit for detecting a peak of said contact probe in the axial direction from the imaged end shape;

a cross-section detecting ~~means~~unit for detecting a cross-sectional area of said contact probe at a position retraced by a predetermined distance in the axial direction from the detected peak;

a first determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range;

a flat part detecting ~~means~~unit for detecting a flat part perpendicular to the axial direction from the imaged end shape;

a curvature detecting ~~means~~unit for sequentially detecting curvatures along a contour of the detected flat part;

a fragment detecting ~~means~~unit for detecting a fragmentary length of the contour over which the detected curvature falls within a predetermined abnormal range;

a second determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of a total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range;

an area detecting ~~means~~unit for detecting the area of the detected flat part;

a diameter detecting ~~means~~unit for detecting a maximum diameter of the detected flat part;

an area calculating ~~means~~unit for calculating the area of the flat part from the detected diameter;

a third determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the detected area to the calculated area falls within a predetermined tolerance range; and

a final determining ~~means~~unit for definitely determining that said contact probe is defective when two of said first determining ~~means~~unit, said second determining ~~means~~unit, and said third determining ~~means~~unit determine that said contact probe is defective.

14. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a probe imaging ~~means~~unit for imaging an end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a peak detecting ~~means~~unit for detecting a peak of said contact probe in the axial direction from the imaged end shape;

a cross-section detecting ~~means~~unit for detecting a cross-sectional area of said contact probe at a position retraced by a predetermined distance in the axial direction from the detected peak;

a first determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range;

a flat part detecting ~~means~~unit for detecting a flat part perpendicular to the axial direction from the imaged end shape;

a curvature detecting ~~means~~unit for sequentially detecting curvatures along a contour of the detected flat part;

a curvature averaging ~~means~~unit for individually averaging a multiplicity of the detected curvature;

a fragment detecting ~~means~~unit for detecting a fragmentary length of the contour over which the averaged curvature falls within a predetermined abnormal range;

a second determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of a total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range;

an area detecting ~~means~~unit for detecting the area of the detected flat part;

a diameter detecting ~~means~~unit for detecting a maximum diameter of the detected flat part;

an area calculating ~~means~~unit for calculating the area of the flat part from the detected diameter;

a third determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the detected area to the calculated area falls within a predetermined tolerance range; and

a final determining ~~means~~unit for definitely determining that said contact

probe is defective when two of said first determining ~~means~~unit, said second determining ~~means~~unit, and said third determining ~~means~~unit determine that said contact probe is defective.

15. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a probe imaging ~~means~~unit for imaging an end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a peak detecting ~~means~~unit for detecting a peak of said contact probe in the axial direction from the imaged end shape;

a cross-section detecting ~~means~~unit for detecting a cross-sectional area of said contact probe at a position retraced by a predetermined distance in the axial direction from the detected peak;

a first determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range;

a flat part detecting ~~means~~unit for detecting a flat part perpendicular to the axial direction from the imaged end shape;

a curvature detecting ~~means~~unit for sequentially detecting curvatures along a contour of the detected flat part;

a fragment detecting ~~means~~unit for detecting a fragmentary length of the contour over which the detected curvature falls within a predetermined abnormal range;

a second determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of a total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range;

an area detecting ~~means~~unit for detecting the area of the detected flat part;

a diameter detecting ~~means~~unit for detecting a maximum diameter of the detected flat part;

an area calculating ~~means~~unit for calculating the area of the flat part from the detected diameter;

a third determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the detected area to the calculated area falls within a predetermined tolerance range; and

a final determining ~~means~~unit for definitely determining that said contact probe is defective when all of said first determining ~~means~~unit, said second determining ~~means~~unit, and said third determining ~~means~~unit determine that said contact probe is defective.

16. (Currently Amended) The probe testing apparatus according to claim 1, further comprising:

a probe imaging ~~means~~unit for imaging an end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a peak detecting ~~means~~unit for detecting a peak of said contact probe in the axial direction from the imaged end shape;

a cross-section detecting ~~means~~unit for detecting a cross-sectional area of said contact probe at a position retraced by a predetermined distance in the axial direction from the detected peak;

a first determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range;

a flat part detecting ~~means~~unit for detecting a flat part perpendicular to the axial direction from the imaged end shape;

a curvature detecting ~~means~~unit for sequentially detecting curvatures along a

contour of the detected flat part;

a curvature averaging ~~means~~unit for individually averaging a multiplicity of the detected curvature;

a fragment detecting ~~means~~unit for detecting a fragmentary length of the contour over which the averaged curvature falls within a predetermined abnormal range;

a second determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of a total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range;

an area detecting ~~means~~unit for detecting the area of the detected flat part;

a diameter detecting ~~means~~unit for detecting a maximum diameter of the detected flat part;

an area calculating ~~means~~unit for calculating the area of the flat part from the detected diameter;

a third determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the detected area to the calculated area falls within a predetermined tolerance range; and

a final determining ~~means~~unit for definitely determining that said contact probe is defective when two of said first determining ~~means~~unit, said second determining ~~means~~unit, and said third determining ~~means~~unit determine that said contact probe is defective.

17. (Currently Amended) A probe testing method for use with a probe testing apparatus for testing the shape of a leading end of a contact probe which is brought into pressure contact with a contact pad on an integrated circuit, said method comprising the steps of:

a detecting a surface shape of at least one of said contact pad and said contact

015.660124.1

probe as three-dimensional data;

an analyzing the surface shape through imaging; and

a determining from the result of the analysis whether said contact probe is acceptable or defective.

18. (Currently Amended) The probe testing method according to claim 17, further comprising:

a pad scanning step for scanning the surface shape of said contact pad in pressure contact with said contact probe to read three-dimensional data of the surface shape;

a part extracting step for differentiating the read surface shape to extract a multiplicity of flat parts;

a reference generating step for complementing the multiplicity of extracted flat parts to generate a reference shape;

a recess detecting step for subtracting said generated reference shape from the read surface shape to detect a plurality of recesses having a predetermined depth or more;

a recess selecting step for selecting one from the plurality of detected recesses corresponding to reference information;

a recess enlarging step for enlarging the selected recess outward by predetermined dimensions;

an impression detecting step for subtracting said reference shape from the read surface shape at the position of the enlarged recess to detect an impression of said contact probe;

a shape detecting step for detecting at least one of a depth, a position and a shape of the detected impression; and

a probe determining step for determining from at least one of the detected depth, position and shape of the impression whether said contact probe is acceptable or defective.

19. (Original) The probe testing method according to claim 17, further comprising:

a pad scanning step for scanning the surface shape of said contact pad in pressure contact with said contact probe to read three-dimensional data of the surface shape;

a surface averaging step for averaging the read surface shape;

a part extracting step for differentiating the averaged surface shape to extract a multiplicity of flat parts;

a reference generating step for complementing the multiplicity of extracted flat parts to generate a reference shape;

a recess detecting step for subtracting said generated reference shape from the averaged surface shape to detect a plurality of recesses having a predetermined depth or more;

a recess selecting step for selecting one from the plurality of detected recesses corresponding to reference information;

a recess enlarging step for enlarging the selected recess outward by predetermined dimensions;

an impression detecting step for subtracting said reference shape from the read surface shape at the position of the enlarged recess to detect an impression of said contact probe;

a shape detecting step for detecting at least one of a depth, a position and a shape of the detected impression; and

a probe determining step for determining from at least one of the detected depth, position and shape of the impression whether said contact probe is acceptable or defective.

20. (Original) The probe testing method according to claim 17, further comprising:

a probe imaging step for imaging the end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a cross-section detecting step for detecting a cross-sectional area of said contact probe at a predetermined position from the imaged end shape; and

a probe determining step for determining whether said contact probe is acceptable or defective depending on the detected cross-sectional area falls within a predetermined tolerance range.

21. (Original) The probe testing method according to claim 17, further comprising:

a probe imaging step for imaging the end shape of said contact probe from an axial direction to read three-dimensional data of the end shape;

a peak detecting step for detecting a peak of said contact probe in the axial direction from the imaged end shape;

a cross-section detecting step for detecting a cross-sectional area of said contact probe at a position retraced by a predetermined distance in the axial direction from the detected peak; and

a probe determining step for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range.

22. (Original) The probe testing method according to claim 17, further comprising:

a probe imaging step for imaging an end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a flat part detecting step for detecting a flat part perpendicular to the axial direction from the imaged end shape;

a curvature detecting step for sequentially detecting curvatures along a contour of the detected flat part;

a fragment detecting step for detecting a fragmentary length of the contour over which the detected curvature falls within a predetermined abnormal range; and

a probe determining step for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of a total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range.

23. (Original) The probe testing method according to claim 17, further comprising:

a probe imaging step for imaging an end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a flat part detecting step for detecting a flat part perpendicular to the axial direction from the imaged end shape;

a curvature detecting step for sequentially detecting curvatures along a contour of the detected flat part;

a curvature averaging step for individually averaging a multiplicity of the detected curvatures;

a fragment detecting step for detecting a fragmentary length of the contour over which the averaged curvature falls within a predetermined abnormal range; and

a probe determining step for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range.

24. (Original) The probe testing method according to claim 17, further comprising:

a probe imaging step for imaging an end shape of said contact probe from the axial direction to read three-dimensional data of the end shape;

a flat part detecting step for detecting a flat part perpendicular to the axial direction from the imaged end shape;

an area detecting step for detecting the area of the detected flat part;

a diameter detecting step for detecting a maximum diameter of the detected flat part;

an area calculating step for calculating the area of the flat part from the detected diameter; and

a probe determining step for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the detected area to the calculated area falls within a predetermined tolerance range.

25. (Currently Amended) A data processing apparatus associated with a probe testing apparatus for determining whether a contact probe is acceptable or defective when said contact probe is in pressure contact with a contact pad on an integrated circuit, said apparatus comprising:

an applying unit ~~means~~ for applying a surface shape of at least one of said contact pad and said contact probe detected as three-dimensional data;

an analyzing unit ~~means~~ for analyzing the surface shape through imaging; and

a determining unit ~~means~~ for determining from the result of the analysis whether said contact probe is acceptable or defective.

26. (Currently Amended) The data processing apparatus according to claim 25, further comprising:

a part extracting ~~means~~unit for differentiating the read surface shape to extract a multiplicity of flat parts;

a reference generating ~~means~~unit for complementing the multiplicity of extracted flat parts to generate a reference shape;

a recess detecting ~~means~~unit for subtracting said generated reference shape from the read surface shape to detect a plurality of recesses having a predetermined depth or more;

a recess selecting ~~means~~unit for selecting one from the plurality of detected recesses corresponding to reference information;

a recess enlarging ~~means~~unit for enlarging the selected recess outward by predetermined dimensions;

an impression detecting ~~means~~unit for subtracting said reference shape from the read surface shape at the position of the enlarged recess to detect an impression of said contact probe;

a shape detecting ~~means~~unit for detecting at least one of a depth, a position and a shape of the detected impression; and

a probe determining ~~means~~unit for determining from at least one of the detected depth, position and shape of the impression whether said contact probe is acceptable or defective.

27. (Currently Amended) The data processing apparatus according to claim 25, further comprising:

a surface averaging ~~means~~unit for averaging the surface shape which is scanned from said contact pad as three-dimensional data;

a part extracting ~~means~~unit for differentiating the averaged surface shape to extract a multiplicity of flat parts;

a reference generating ~~means~~unit for complementing the multiplicity of extracted flat parts to generate a reference shape;

a recess detecting ~~means~~unit for subtracting said generated reference shape from the averaged surface shape to detect a plurality of recesses having a predetermined depth or more;

a recess selecting ~~means~~unit for selecting one from the plurality of detected recesses corresponding to reference information;

a recess enlarging ~~means~~unit for enlarging the selected recess outward by

predetermined dimensions;

an impression detecting ~~means~~unit for subtracting said reference shape from the read surface shape at the position of the enlarged recess to detect an impression of said contact probe;

a shape detecting ~~means~~unit for detecting at least one of a depth, a position and a shape of the detected impression; and

a probe determining ~~means~~unit for determining from at least one of the detected depth, position and shape of the impression whether said contact probe is acceptable or defective.

28. (Currently Amended) The data processing apparatus according to claim 25, further comprising:

a cross-section detecting ~~means~~unit for detecting a cross-sectional area of said contact probe at a predetermined position thereof from the end shape imaged from said contact probe as three-dimensional data; and

a probe determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range.

29. (Currently Amended) The data processing apparatus according to claim 25, further comprising:

a peak detecting ~~means~~unit for detecting a peak of said contact probe in the axial direction from the end shape imaged from said contact probe as three-dimensional data;

a cross-section detecting ~~means~~unit for detecting a cross-sectional area of said contact probe at a position retraced by a predetermined distance in the axial direction from the detected peak; and

a probe determining ~~means~~unit for determining whether said contact probe is

acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range.

30. (Currently Amended) The data processing apparatus according to claim 25, further comprising:

a flat part detecting ~~means~~unit for detecting a flat part perpendicular to the axial direction from the end shape imaged from said contact probe as three-dimensional data;

a curvature detecting ~~means~~unit for sequentially detecting curvatures along a contour of the detected flat part;

a fragment detecting ~~means~~unit for detecting a fragmentary length of the contour over which the detected curvature falls within a predetermined abnormal range; and

a probe determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of a total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range.

31. (Currently Amended) The data processing apparatus according to claim 25, further comprising:

a flat part detecting ~~means~~unit for detecting a flat part perpendicular to the axial direction from the end shape imaged from said contact probe as three-dimensional data;

a curvature detecting ~~means~~unit for sequentially detecting curvatures along a contour of the detected flat part;

a curvature averaging ~~means~~unit for individually averaging a multiplicity of the detected curvatures;

a fragment detecting ~~means~~unit for detecting a fragmentary length of the contour over which the averaged curvature falls within a predetermined abnormal range; and

a probe determining ~~means~~unit for determining whether said contact probe is

acceptable or defective depending on whether or not the ratio of the total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range.

32. (Currently Amended) The data processing apparatus according to claim 25, further comprising:

a flat part detecting ~~means~~unit for detecting a flat part perpendicular to the axial direction from the end shape imaged from said contact probe as three-dimensional data;

an area detecting ~~means~~unit for detecting the area of the detected flat part;

a diameter detecting ~~means~~unit for detecting a maximum diameter of the detected flat part;

an area calculating ~~means~~unit for calculating the area of the flat part from the detected diameter; and

a probe determining ~~means~~unit for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the detected area to the calculated area falls within a predetermined tolerance range.

33. (Original) A data processing method for use with a data processing apparatus associated with a probe testing apparatus for determining whether a contact probe is acceptable or defective when said contact probe is in pressure contact with a contact pad on an integrated circuit, said method comprising the steps of:

applying a surface shape of at least one of said contact pad and said contact probe detected as three-dimensional data;

analyzing the surface shape through imaging; and

determining from the result of the analysis whether said contact probe is acceptable or defective.

34. (Original) The data processing method according to claim 33, further comprising:

a part extracting step for differentiating the read surface shape to extract a multiplicity of flat parts;

a reference generating step for complementing the multiplicity of extracted flat parts to generate a reference shape;

a recess detecting step for subtracting said generated reference shape from the read surface shape to detect a plurality of recesses having a predetermined depth or more;

a recess selecting step for selecting one from the plurality of detected recesses corresponding to reference information;

a recess enlarging step for enlarging the selected recess outward by predetermined dimensions;

an impression detecting step for subtracting said reference shape from the read surface shape at the position of the enlarged recess to detect an impression of said contact probe;

a shape detecting step for detecting at least one of a depth, a position and a shape of the detected impression; and

a probe determining step for determining from at least one of the detected depth, position and shape of the impression whether said contact probe is acceptable or defective.

35. (Original) The data processing method according to claim 33, further comprising:

a surface averaging step for averaging the surface shape which is scanned from said contact pad as three-dimensional data;

a part extracting step for differentiating the averaged surface shape to extract a multiplicity of flat parts;

a reference generating step for complementing the multiplicity of extracted

flat parts to generate a reference shape;

a recess detecting step for subtracting said generated reference shape from the averaged surface shape to detect a plurality of recesses having a predetermined depth or more;

a recess selecting step for selecting one from the plurality of detected recesses corresponding to reference information;

a recess enlarging step for enlarging the selected recess outward by predetermined dimensions;

an impression detecting step for subtracting said reference shape from the read surface shape at the position of the enlarged recess to detect an impression of said contact probe;

a shape detecting step for detecting at least one of a depth, a position and a shape of the detected impression; and

a probe determining step for determining from at least one of the detected depth, position and shape of the impression whether said contact probe is acceptable or defective.

36. (Original) The data processing method according to claim 33, further comprising:

a cross-section detecting step for detecting a cross-sectional area of said contact probe at a predetermined position thereof from the end shape imaged from said contact probe as three-dimensional data; and

a probe determining step for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range.

37. (Original) The data processing method according to claim 33, further comprising:

a peak detecting step for detecting a peak of said contact probe in the axial direction from the end shape imaged from said contact probe as three-dimensional data;

a cross-section detecting step for detecting a cross-sectional area of said contact probe at a position retraced by a predetermined distance in the axial direction from the detected peak; and

a probe determining step for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range.

38. (Original) The data processing method according to claim 33, further comprising:

a flat part detecting step for detecting a flat part perpendicular to the axial direction from the end shape imaged from said contact probe as three-dimensional data;

a curvature detecting step for sequentially detecting curvatures along a contour of the detected flat part;

a fragment detecting step for detecting a fragmentary length of the contour over which the detected curvature falls within a predetermined abnormal range; and

a probe determining step for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of a total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range.

39. (Original) The data processing method according to claim 33, further comprising:

a flat part detecting step for detecting a flat part perpendicular to the axial direction from the end shape imaged from said contact probe as three-dimensional data;

a curvature detecting step for sequentially detecting curvatures along a contour of the detected flat part;

a curvature averaging step for individually averaging a multiplicity of the detected curvatures;

a fragment detecting step for detecting a fragmentary length of the contour

over which the averaged curvature falls within a predetermined abnormal range; and

a probe determining step for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range.

40 (Original) The data processing method according to claim 33, further comprising:

a flat part detecting step for detecting a flat part perpendicular to the axial direction from the end shape imaged from said contact probe as three-dimensional data;

an area detecting step for detecting the area of the detected flat part;

a diameter detecting step for detecting a maximum diameter of the detected flat part;

an area calculating step for calculating the area of the flat part from the detected diameter; and

a probe determining step for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the detected area to the calculated area falls within a predetermined tolerance range.

41 (Original) An information storage medium having a computer program stored thereon for a data processing apparatus associated with a probe testing apparatus for determining whether a contact probe is acceptable or defective when said contact probe is in pressure contact with a contact pad on an integrated circuit, said computer program causing said data processing apparatus to execute the processing of:

applying a surface shape of at least one of said contact pad and said contact probe detected as three-dimensional data;

analyzing the surface shape through imaging; and

determining from the result of the analysis whether said contact probe is

acceptable or defective.

42 (Original) The information storage medium according to claim 41, wherein said computer program further causes said data processing apparatus to execute:

part extraction processing for differentiating the read surface shape to extract a multiplicity of flat parts;

reference generation processing for complementing the multiplicity of extracted flat parts to generate a reference shape;

recess detection processing for subtracting said generated reference shape from the read surface shape to detect a plurality of recesses having a predetermined depth or more;

recess selection processing for selecting one from the plurality of detected recesses corresponding to reference information;

recess enlargement processing for enlarging the selected recess outward by predetermined dimensions;

impression detection processing for subtracting said reference shape from the read surface shape at the position of the enlarged recess to detect an impression of said contact probe;

shape detection processing for detecting at least one of a depth, a position and a shape of the detected impression; and

probe determination processing for determining from at least one of the detected depth, position and shape of the impression whether said contact probe is acceptable or defective.

43 (Original) The information storage medium according to claim 41, wherein said computer program further causes said data processing apparatus to execute:

surface averaging processing for averaging the surface shape which is scanned

from said contact pad as three-dimensional data;

part extraction processing for differentiating the averaged surface shape to extract a multiplicity of flat parts;

reference generation processing for complementing the multiplicity of extracted flat parts to generate a reference shape;

recess detection processing for subtracting said generated reference shape from the averaged surface shape to detect a plurality of recesses having a predetermined depth or more;

recess selection processing for selecting one from the plurality of detected recesses corresponding to reference information;

recess enlargement processing for enlarging the selected recess outward by predetermined dimensions;

impression detection processing for subtracting said reference shape from the read surface shape at the position of the enlarged recess to detect an impression of said contact probe;

shape detection processing for detecting at least one of a depth, a position and a shape of the detected impression; and

a probe determination processing for determining from at least one of the detected depth, position and shape of the impression whether said contact probe is acceptable or defective.

44 (Original) The information storage medium according to claim 41, wherein said computer program further causes said data processing apparatus to execute:

cross-section detection processing for detecting a cross-sectional area of said contact probe at a predetermined position thereof from the end shape imaged from said contact probe as three-dimensional data; and

probe determination processing for determining whether said contact probe is

acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range.

45 (Original) The information storage medium according to claim 41, wherein said computer program further causes said data processing apparatus to execute:

peak detection processing for detecting a peak of said contact probe in the axial direction from the end shape imaged from said contact probe as three-dimensional data;

cross-section detection processing for detecting a cross-sectional area of said contact probe at a position retraced by a predetermined distance in the axial direction from the detected peak; and

probe determination processing for determining whether said contact probe is acceptable or defective depending on whether or not the detected cross-sectional area falls within a predetermined tolerance range.

46 (Original) The information storage medium according to claim 41, wherein said computer program further causes said data processing apparatus to execute:

flat part detection processing for detecting a flat part perpendicular to the axial direction from the end shape imaged from said contact probe as three-dimensional data;

curvature detection processing for sequentially detecting curvatures along a contour of the detected flat part;

fragment detection processing for detecting a fragmentary length of the contour over which the detected curvature falls within a predetermined abnormal range; and

probe determination processing for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of a total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range.

47 (Original) The information storage medium according to claim 41, wherein said computer program further causes said data processing apparatus to execute:

flat part detection processing for detecting a flat part perpendicular to the axial direction from the end shape imaged from said contact probe as three-dimensional data;

curvature detection processing for sequentially detecting curvatures along a contour of the detected flat part;

curvature averaging processing for individually averaging a multiplicity of the detected curvatures;

fragment detection processing for detecting a fragmentary length of the contour over which the averaged curvature falls within a predetermined abnormal range; and

probe determination processing for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the total of the detected fragmentary lengths to the overall length of the contour falls within a predetermined tolerance range.

48 (Original) The information storage medium according to claim 41, wherein said computer program further causes said data processing apparatus to execute:

flat part detection processing for detecting a flat part perpendicular to the axial direction from the end shape imaged from said contact probe as three-dimensional data;

area detection processing for detecting the area of the detected flat part;

diameter detection processing for detecting a maximum diameter of the detected flat part;

area calculation processing for calculating the area of the flat part from the detected diameter; and

probe determination processing for determining whether said contact probe is acceptable or defective depending on whether or not the ratio of the detected area to the calculated area falls within a predetermined tolerance range.